

**Name:**

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**Title of Degree:**

Masters in Technology and Learning

**Title of Dissertation:**

As Part of a 21<sup>st</sup> Century Learning Activity, an Investigation into the Effect of Utilising a Synthesized Problem Solving Model in a Microworld Simulation to Develop Problem Solving Skills in Maths Education

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## **Abstract**

In 2011, the National Council for Curriculum and Assessment (NCCA) in Ireland introduced the new Junior Cycle Framework in Ireland. This framework was established and designed to prepare our students with a collection of eight key skills of which problem solving skills are highlighted as a key component. Problem solving skills are also imperative in the new mathematics curriculum "Project Maths" which was introduced to post primary schools in Ireland in 2008.

Problem solving has always being an integral part to mathematical curriculums around the world and a vast array of research has been conducted to enhance the teaching and learning of problem solving. Students and teachers have found it difficult to grasp the idea of developing problem solving skills for various reasons. Reviewing the literature has highlighted that the delivery of maths education has often focused on procedures and routine step-by-step approaches to achieve solutions. As a result, levels of disengagement and dissatisfaction have been associated with the teaching and learning of maths.

To address the issue of enhancing student's skills in problem solving, this dissertation examines existing models and frameworks that assist in problem solving and devises a new model one based on a synthesis of those models. It then investigates the effectiveness of the model in assisting students to develop metacognitive skills (planning, monitoring and reflection) when problem solving. Becoming an efficient problem solver depends on a range of factors including knowledge, skills, attitudes and context. This study will examine the effect on using a synthesised problem solving model to develop one aspect when problem solving, the use of metacognitive skills.

The literature review highlighted the value of incorporating a social constructivist and constructionist pedagogy in educational settings. Research has indicated to the potential benefits this can have in developing levels of understanding, performance and engagement in learning activities among students. Allowing students to be an active part in constructing knowledge can help students when problem solving. Similarly, the affordances of technology in education to transform and refine the learning experience has been documented recently. The affordance of technology to allow students to interact, visualise, design, create and reflect their work in an immersive dynamic learning environment has been highlighted. The use of technology could potentially allow students to develop these skills.

Recent research has shown the Bridge 21 pedagogical model for 21<sup>st</sup> century learning as being successful in delivering 21<sup>st</sup> century learning experiences, which incorporate the use of technology. The dissertation uses the Bridge 21 model, to deliver the learning activities

In light of these findings from the literature five key components including 1) the pedagogical approach, 2) the problem solving model, 3) the role of metacognition, 4) the inclusion of technology and 5) a 21<sup>st</sup> century learning framework, informed the design of the learning intervention created to investigate the research question.

The main research question asked in this study is “*Does the use of the synthesized problem solving model (SPSM), enhance problem solving skills and metacognitive skills when problem solving?*”

An exploratory and explanatory case model was conducted to collect data to address the research questions proposed. A learning intervention was implemented for 8-10 hours over three-week period with a total 21 student participating in the research. The students interacted in a series of problem solving activities using a Microworld simulation while using the synthesised problem-solving model to develop their metacognitive skills.

A convergent mixed methods methodology was used in this dissertation. A mix of qualitative and quantitative data was collected and triangulated to highlight any significant findings in the investigation. The findings from the research highlight a statistically significant increase in the participant’s metacognitive skills. The positive role of the Microworld and Bridge 21 learning framework on developing student’s metacognitive and problem solving skills is discussed. The limitations of this research are outlined due to the small sample size of participants, however further areas of research are discussed.